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SOME PRESENT-DAY PROBLEMS OF ZOOLOGY TEACHING[1]

By Professor WILLIAM A. RILEY

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IN coming before you to-night I wish first to express my appreciation of the high honor of being chosen to serve as vice-president of the section set aside for the zoologists in this great organization of American men of science.

It happens that, owing to the absence of our vice-president of last year, there has been introduced a new policy, that of asking the newcomer to give the annual address. When the readjustment is being made both the speaker and his audience are aware of some of the advantages of the older policy.

My predecessors in Section F have dealt with a widely varied list of topics. Some have discussed in a trenchant manner that special field of research which they have personally cultivated, others have dealt with more general problems or have surveyed the accomplishments of recent years in some particular field of zoology.

There is another aspect which is a very live problem in educational work, but which we are inclined to give scant attention. I refer to the ever-growing complaint regarding the teaching of the sciences. Perhaps its consideration might better be left to other groups, but I have had the temerity to choose for to-night this general subject and I shall ask your indulgence while I speak of "Some Present-day Problems of Zoology Teaching." Let me hasten to explain that I do not intend to suggest some new method of examinations, nor of mid-term or weekly or daily reports. Neither do I pose as an educational expert—my dis-

[1] Address of the vice-president and chairman of Section F—Zoology, American Association for the Advancement of Science, Cleveland, December 31, 1930.

cussion is frankly based by my interests in zoology and in the propagation of zoological interests in others.

Wherever zoologists congregate there is stress, and rightly, on the importance of research. It is the mainspring of any science, without which progress is impossible. Genuine interest in it is one of the most valuable aids to successful teaching in spite of insistent charges to the contrary.

Nevertheless, it is not the only means by which a science advances. Bacon, three centuries ago, in his classic volume "The Advancement of Learning," discussed not only the methods by which knowledge is to be gained but also the importance of making it intelligible to society at large. Indeed, our American Association for the Advancement of Science recognizes this popularization of science as one of its functions and is devoting an ever-increasing amount of attention to the problem.

Our interests, then, are dual, but there would seem little necessity of emphasizing before this group the importance of research. Your very presence at these Convocation Week meetings testifies to your interest it it.

Foremost among all the agencies for bringing about the diffusion of knowledge is classroom instruction. The entire group here present is concerned directly or indirectly with the teaching of zoology, however varied the proportion of time available for individual investigations. As teachers or as researchers we shall be more and more affected by some of the present-day trends in our colleges and universities. Their name is legion, and they are already doing much to determine the type of students in our classes and in our graduate schools. Perhaps some of you will not agree when I select as the most important three affecting our work those of (1) the changed view-point regarding the function of the university; (2) the position of laboratory work, and (3) those affecting departmental curricula. In discussing them, I shall treat of what I believe to be general rather than regional or institutional trends.

The one most vitally affecting our work and that on which the others are ultimately dependent is the remarkable shift which has come in the conception of the aims and function of the university. There have been and are to-day many attempts to define this function, but we may class them as (1) those which conceive of the university as the capstone of the educational system, obedient to public demands, and accepting any graduate of the secondary schools of the state, and (2) those which conceive of the university as a leader in educational ideals, accepting students who have demonstrated their ability for more advanced work, and not concerned with what Dr. Keppel has called the "period of extended infancy."

It is needless to say that these are diametrically opposed view-points and, however great the efforts on the part of those who are struggling to reconcile them, one or the other ultimately must give way. There will be lone schools which will stand against the current for a considerable period, but so inextricably are educational institutions interrelated that none can escape the influence of the dominant conception.

There can be no doubt that even to-day that dominant conception has become one of an unbroken system from the kindergarten to the graduate school, and already there are demands that its requirements and standards be adjusted to accommodate the hordes who must have a doctor's degree in order to obtain or to hold a position in our colleges. In many places the slogan is "Whosoever will may come and partake freely of the Pierian spring," and coupled with it there is not infrequently the implied suggestion within the institution that he should not be required to drink deeply, since the object of the universities is to "prepare the student for life,"[2] rather than to make a scholar of him. A recent writer has expressed clearly his own and a common opinion when he says, "The outside citizens are the ultimate deciders of school policies, they hold the purse strings, they own the schools. Educators are their employees."

I would not by any means imply that this policy is motivating all our state universities. There are certain notable exceptions and few, if any, have yielded altogether. On the other hand, I believe that it is a fair statement of the trend and that long before the swing of the pendulum is reversed, our endowed institutions, too, will be radically affected by it. Indeed, they are by no means immune to-day.

Many are the attempts to stem the tide. Probably the most in favor at present is the establishment of junior colleges which will care for not only those students who do not expect to continue beyond two years but also for those from the neighborhood who expect to go on to completion of the college course. Already there is ample reason to see that this will only double the difficulties. In general, the equipment, library facilities and teaching staff of these institutions are in nowise comparable to those of the universities. They are more lenient in accepting their students. The result is that there will exist the same gulf between their courses and those of the senior colleges that is now the source of complaint from the high schools. In the one as in the other case the proposed

[2] This slogan, so widely used, does nothing in the way of defining what is the best preparation our universities can offer. All conflicting viewpoints claim its guidance.

remedy will be that of lowering the requirements of the advanced work.

The effects of the movement are all-pervasive. The graduate schools are accepting more and more of non-resident study, or Saturday afternoon, evening and correspondence courses. This is despite the fact that one of the most valuable features of graduate study is the contact with seminars, library facilities and, presumably, the atmosphere of research. The requirements of two modern languages are being vigorously attacked and in various quarters the substitution of educational statistics for one or even both of the languages is a matter of routine. The largest of our schools of education has frankly waived the rule that the Ph.D. thesis must represent an original contribution.

I am not here discussing whether these changes throughout our whole university system are desirable or not—I am merely pointing out that they are rapidly coming about. Inevitably they affect our science courses and the rôle which our departments of zoology can play in the system of education. Are, first, our beginning courses and then our intermediate, and, finally, the advanced courses to become merely informational in nature, supplanting the old-time Chautauqua lectures, or are they to adhere to an ideal of giving all their students the best possible training under the limitations which exist and of developing and stimulating a scholarly attitude towards the subject?

Despite the antagonisms and, later, the evasions which prevailed in the latter part of the nineteenth century, it is no longer necessary for the proponents of science teaching to battle for recognition of their field by the schools and colleges. Some of the discussions of that period and particularly the essays and addresses of Huxley are well worth reading. It is as true to-day as it was in 1869 that "if the great benefits of scientific training are sought, it is essential that such training should be real; that is to say, that the mind of the scholar should be brought into direct relation with fact, that he should not merely be told a thing but made to see by the use of his own intellect and ability that the thing is so, and no otherwise."

Gradually the educational world came to accept the idea that the study of science deserved a place with the classics in the curriculum because it did bring the mind directly into contact with fact and strove to train it in the acquisition of first-hand knowledge. So fully has it been accepted that it is now the classics which are on the defensive and in all too many places are struggling for existence.

The driving force of the movement, then, was the stress on the value of the laboratory method. "If scientific education is to be dealt with as mere bookwork it will be better not to attempt it but to stick to the Latin grammar which makes no pretense at anything but bookwork" was Huxley's warning and in this country it was matched by Agassiz's "Study nature, not books"—a slogan which was not directed at books but at servile dependence upon them.

In those benighted days it had not been discovered that "the most evil influence in education" was the scholar and it was natural that the attitude of leaders in the colleges and universities should be manifested in the secondary school teaching of science. It must be admitted that the result was not always wholesome, though there is ample room for question as to whether the present-day tendency in the other direction affords a sound substitute.

Be that as it may, it is true that the more progressive high schools attempted to duplicate in so far as their finances permitted the equipment and the methods of the college laboratory. To be sure, there came from both college and secondary schools vigorous protests against the cost of such instruction. Years ago Youmans admitted that "of the two classes that may be taken generally as most ignorant of the science of their business—cooks and congressmen—it will cost at least ten times more properly to educate the former than the latter."

Still more serious was the fact that at times the newly created B.S. went into these schools with little idea other than to duplicate as nearly as possible the course which he had taken in college. Often he had little conception as to how to proceed until he had gotten an equipment of microscopes, sea urchins, dogfish, Grantia and starfish. The results were likely to be disastrous and the zoological departments of the colleges were to a considerable degree responsible for these misfits. As long as the majority of college departments of zoology were themselves ignoring the wealth of material in the local fauna it was too much to expect that their product would realize the potentialities of his environs or have any particular interest in the population of its fields and streams. As long as the college departments were insulated from the work of the secondary schools it is small wonder that their graduates had no idea of the problems which they would face if they were called upon to teach in these schools.

This situation, coupled with the acute problems arising from the crowding of our high schools, attracted an ever-increasing amount of attention on the part of those responsible for the development and administration of secondary education. To-day the validity of the claims for laboratory instruction is being challenged sharply and more and more there

is coming about a reversion to text-book instruction or to lectures—the incipient text-books—supplemented in varying degree by classroom demonstrations. This movement is rapidly extending to our colleges and universities where it is manifested in the increasing demand for survey courses in which the laboratory method plays no part. Forgotten are the arguments which opened up the curricula to the biological sciences. Must we consider this a retrogression? Perhaps they *should* be forgotten, for there is no more excuse for a static education than there is for a static science.

A considerable factor in the decreasing emphasis on laboratory work is unquestionably the economic one. The faculty of making a virtue of necessity is one of the beneficent anodynes afforded mortals. If it is found that it is physically impossible to provide space and equipment for the hordes of incoming students, and if the motivating educational philosophy demands that they all be welcomed, then it is to be expected that expensive types of instruction would be subject to particular scrutiny, and substitutes receive at least a very sympathetic consideration.

It would be unfair and superficial to assume that the question of expense is the only one involved or even, in most cases, that it is the primary one.

There never has been any agreement as to just the proportions in which lecture, demonstration, charts and lantern-slides and laboratory work should be mixed. We may individually have very definite opinions, but we do not have any satisfactory methods of tasting the concoction while it is stewing. We may believe firmly in a rigid application of the methods of Agassiz, but no advocate of large classes has yet offered a clue as to how such technique can be followed under the conditions which face us. Is there no approach to the problem other than that of observation and opinion?

The present century has seen the introduction of methods of psychological research which are influencing profoundly and will continue to influence our systems of education. They have emanated from a small group of thoroughly trained investigators, capable of self-criticism and motivated, as every scientist must be, by a desire to learn the truth and as nearly as possible the whole truth about their problems. They were great teachers, untrammeled by standardized methods, and capable of enthusing and stimulating the students with whom they come in contact.

Unfortunately, among their followers are not only many serious and careful workers but also zealots with scant preparation, whose chief efforts apparently have been devoted to criticism of our colleges and to attempting to carry over into the universities the methods and ideals of the public schools. The result has been that, instead of contributing to the improvement of teaching in the colleges through work that wins respect by its scholarly approach and tempered criticism, they have often antagonized, and have failed to receive credit for whatever of merit they may have presented. The constant iteration and reiteration of the claim that the worst teaching in the country is college teaching is an illustration of a type of mischievous and irresponsible statement which is doing nothing to better conditions. Neither is the assumption that there has not been in the past any constructive thought devoted to efficient presentation of the subject-matter of the sciences or that the whole situation can be revolutionized by a statistical study of the results of examinations.

However, none of this excuses a teacher of zoology from attempting to keep in touch with the real research work which is being done on methods of presenting his subject, or from constantly checking over and attempting to improve his work. When he reaches the stage of having no interest in such matters it would be better for himself and his institution if he could be retired.

If he be scientifically trained, as fortunately may still be assumed, he will not accept at face value every piece of experimental work which finds its way into the literature. Neither will he be justified in treating his students always as subjects for investigation. There are a few groups of peoples which have been more or less tacitly regarded as legitimate experimental material—condemned criminals, subject nations and men under rigid military discipline. To these we are now adding the students of our schools and colleges, but the teacher who regards his students in that light is no more able to do his best for them than is the doctor whose first concern in meeting his patients is the study of the action of some particular drug. There may be exaggeration and a note of irritation in the charge by a recent writer that "teachers instead of teaching are everywhere fetching and carrying for the investigators," but it is certainly normally the case that " in just the degree in which a teacher is an inspiration to his pupils he is unfitted as a collector of statistics."

To the present there has not been developed any adequate measure of the effects of laboratory work on the student. It is comparatively easy to measure the retention of facts in sufficient degree to pass examination, but no believer in laboratory work considers that its chief value is as an adjunct to the cramming process. To be sure it is quite as *passé* to con-

sider that habits of accuracy, sincerity and respect for scientific evidence could be inculcated through laboratory work as that any subject possesses abstract disciplinary value. I would point out, though, that Thorndike himself never took the extreme view which is often attributed to him but that he definitely taught that the results of training could be transferred and that even where this was much less than had previously been assumed it had a very significant value. Reference to "intangible effects" are anathema to many of the enthusiastic devotees of the new research and yet every earnest teacher knows that they can not be ignored. Their number will be reduced as the technique of investigation becomes refined, but we must agree with Archibald Rutledge that "it is exceedingly doubtful whether that mysterious whole which we term personality will ever yield to investigators, however patient, honest and meticulous in their searchings they may be." It is on this personality that the intangibles become inextricably impressed.

I have listed as a third topic certain trends in the setting up of departmental curricula. In not a few cases these are the antithesis of what I have already discussed. Perhaps they are defense reactions, more or less consciously developed. In any event they will affect in no little degree the future development of our subject.

In our large institutions of to-day departments are allowed a very considerable latitude in the fixing of the requirements for their major students, however much their introductory courses are shaped by demands for popularization. Apart from the fact that the elementary courses in high school and college have already done much to fix the student's ideals of work and his thought processes, this still permits of the development of a well-rounded departmental course for students who are particularly interested in zoological work. It is of the utmost importance that the responsibility be accepted and administered in such manner as to develop the student to the maximum degree.

Of the various ways in which this development may be hindered a not uncommon one is too great a stress upon some narrow field in which the teacher is interested. It is of great advantage to the young student to be associated with an investigator in the study of a section of a problem, if it is not at the expense of a breadth of preparation which will be essential to the success of that student when he leaves the university. There are cases in which a teacher who owes much of his success to his own broad training overlooks the fact that some of his efficient students are little more than expert technicians.

Again, there may be the mistake of setting up a rigid curriculum which either does not allow for sufficient recognition of the aptitudes and natural interests of the student or, on the other hand, so monopolizes his time as to make it impossible for him to take advantage of and learn to appreciate the cultural opportunities afforded by work outside of his specialty.

In all ages the greatest teachers have been concerned with the development of the individuality of the student. There is general agreement to-day that this is the highest goal of education, however much we hamper it by some of our practices.

The field of zoology is a broad one and capable of profiting greatly from the work of students of widely varying tastes and interests. The best development of the student demands that we treat him as an individual—a problem much easier of solution in the limited confines of a department than in the institutions as a whole. To set up a uniform requirement for all who are attracted to the field is no more justifiable than was the adherence to the single universal curriculum of the old-time college. This discarded policy was supported by arguments which are strictly analogous to those used in favor of rigid departmental requirements.

The monopolizing of the student's time, at the expense of his fuller development, is another danger to be avoided in this process of setting up an ideal program for making a zoologist. As soon as we start out on the theory that "surely anybody who is going to major in zoology should have . . ." we find that we have filled his undergraduate years with chemistry, zoology, botany, physics, mathematics, foreign languages, geology and special courses in zoology. Where have we allowed for the student's development of any appreciation of the literature of these foreign languages or of our own language, where for philosophy, history, sociology or the other fields of knowledge which, if not opened up in the undergraduate days, are very probably destined to be forever closed to him? Is there not a danger of unconsciously adopting a trade-school ideal rather than supporting that of *education* in contrast to mere *instruction*?

The science of zoology has made unparalleled advances during the past century. We owe it to the present to make the knowledge already gained more generally available and to stimulate the workers of the next generation to still greater achievements. If it seems, sometimes, that our educational systems are milling around in a confusing conflict of ideals and aims—of readiness to size upon anything new, and of conservatism—let us at least hope that there is a spiral upward movement and let us do our share to make it manifest in our chosen field.

PLANES OF LATERAL CORRASION

By Professor DOUGLAS JOHNSON

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NEARLY thirty years ago the writer studied in central New Mexico a very perfect erosion plane surrounding and sloping gently away from the Cerrillos, Ortiz, Sandia and Santa Fé Mountains. Near the ranges the plane usually was cut in igneous or other resistant rock of the mountain core; farther out it neatly bevelled the upturned edges of sandstones, limestones and shales which had been steeply tilted by the mountain uplifts. Close to the ranges the erosion plane was masked by a relatively thin cover of alluvial gravels, or was fully exposed to view as a smooth rock floor, sometimes well preserved, sometimes dissected to give a belt of low foothills, having remarkably accordant summits. Away from the mountains the alluvial cover thickened, and only the fortunate circumstance that later erosion had deeply trenched the country made it possible to observe the depth of the alluvium and the perfection of the buried erosion surface.

The results of the writer's studies were published in 1903–1904 in a medium which has quite naturally escaped the attention of later students of this type of erosion surface.[1] While recognizing that the far-spreading erosion plane of the Cerrillos region bore some resemblance to peneplanes described in the literature, I hesitated to apply this term to a form which was truly plane over broad areas; nor could I ascribe its development to the normal processes of peneplanation as then understood. Neither did it seem reasonable to credit sheet-flood erosion with the initial development of such a surface, although this process might be responsible for further erosion of a plane once formed. The most helpful suggestion came from a perusal of Gilbert's "Geology of the Henry Mountains." That fertile thinker invoked the lateral corrasion of streams to explain the "planation" of tilted sedimentaries in such manner as to produce inclined erosion surfaces identical in character with those of the Cerrillos Hills and adjacent areas. The writer therefore stated that "the phenomena are essentially those described by Gilbert as the results of 'planation'" and added in another connection that "sheet-flood erosion was doubtless an important factor in this process of 'planation.'"

In later years increasing attention has been directed to inclined erosion planes surrounding mountain masses in arid regions. Lawson's critical analysis of the "suballuvial bench" and related forms, and Bryan's excellent studies of "pediments" have been especially valuable in spreading a knowledge of these forms and in provoking further study of their origin. Compared with these and other able studies my own early account now appears to me what it really is—the crude and incomplete discussion by an inexperienced student of a novel problem which he did not fully understand. And yet my brief and imperfect account presents two features which perhaps entitle it to some consideration: It describes (although too briefly) the most beautiful examples of rock pediments or suballuvial benches ever seen by me in the field or, so far as I can judge from the printed page, yet pictured in the literature; and, unlike the later discussions referred to, it follows Gilbert in ascribing to lateral corrasion by streams the dominant rôle in sculpturing planes of this type.

I have followed the growing literature on the subject of planation surfaces with some care, and with an ever-deepening conviction that Gilbert's early contribution to the subject has failed to receive the attention it deserves. The failure is due, perhaps, to the fact that Gilbert never elaborated his suggestion to the point where its full significance became manifest. For many years I have been emphasizing to my students what have seemed to me certain superiorities of the Gilbertian hypothesis; and some of these students have followed Gilbert in their published work.[2] Otherwise I have found but one authority who seems to have shared the conviction that Gilbert has most correctly explained the process by which piedmont erosion planes are formed. Unknown to the writer Eliot Blackwelder, as a result of his desert studies, independently reached the same opinion, a fact brought to my attention in personal conversation with him last spring.

In the years since my first introduction to such planes in the Cerrillos Hills, I have from time to time tried to analyze Gilbert's idea with the aid of accumulating knowledge concerning these planes, to develop the theory more fully than did that author, and to deduce its reasonable consequences to the point where we might test the validity of the theory by critical field evidence. By 1929 this deductive study

[1] Douglas Johnson, "Geology of the Cerrillos Hills, New Mexico." *Columbia University School of Mines Quarterly*, xxiv, 173–246, 303–350, 456–500, 1903; xxv, 69–98, 1904.

[2] See, for example, the discussions of lateral planation by F. K. Morris in Berkey and Morris's "Geology of Mongolia," Natural History of Central Asia, Vol. II, 475 pp., New York, 1927.

had reached the point where it seemed desirable to examine in the field certain well-developed piedmont erosion surfaces in order to compare the availability of the several hypotheses advanced by Gilbert, Lawson, Bryan, and others. The writer was granted a year's leave of absence from academic duties at Columbia University for the purpose of making this and certain other studies related, directly or indirectly, to the broader problem of changes in continental elevation. Among the regions visited were South Africa, New Zealand, and the southwestern United States including the Sacaton Mountains and Cerrillos Hills districts, in all of which areas important evidence regarding the nature and origin of piedmont erosion planes was secured. A full discussion of the Gilbertian hypothesis as developed and modified by the writer, together with a somewhat extended account of the most interesting localities studied, will appear elsewhere. The object of the present article is briefly to outline the salient points in the theory, and to indicate a few of the more significant conclusions which may be based upon it.

Gilbert's statement[3] of the theory of lateral planation is simple and concise. He points out that downward wear of streams ceases when the load equals the capacity for transportation. Lateral corrasion then becomes relatively and actually of importance, and carves an even surface covered by a thin deposit of alluvium. By cutting laterally into each others' valleys and consuming all remnants of the intervening divides neighboring streams cooperate to carve a single plane of broad extent. Gilbert does not discuss many details of the process, and certain of his assumptions seem open to question. But the essence of the theory of lateral planation is stated with the clarity of logical deduction characteristic of his writings.

We may by further deduction expand Gilbert's idea to the following form: Every stream is, in all its parts, engaged in the three processes of (*a*) vertical downcutting or degrading, (*b*) upbuilding or aggrading, and (*c*) lateral cutting or planation. Under different conditions one or another of these processes may become more important, and the other two operate less vigorously or intermittently. If we imagine an isolated mountain mass in an arid region, it will be evident that the gathering ground of streams in the mountains, where greater precipitation occurs, will normally be the region where vertical cutting is at its maximum. Aggradation will be intermittent, local and temporary. Lateral cutting will be vigorous, and for every hundred feet of downcutting two or more hundred feet of lateral movement of the stream may take place. But even so the deepening process keeps the valleys youthful in character, with narrow bottoms and relatively steep sides. Valley deepening appears dominant, even if it be actually subordinate to lateral corrasion.

Far out from the mountain mass conditions are reversed. Each stream must distribute its water and its load over an ever-widening sector of country. The water disappears, whether by evaporation or by sinking into the accumulating alluvium. Aggradation is at its maximum, and vertical downcutting is intermittent in character and both local and limited in extent. Lateral corrasion may be dominant in fact, the streams shifting hundreds or thousands of feet laterally for every hundred feet of upbuilding. But the thing which impresses the observer is the ever-thickening mantle of alluvium. Aggradation appears dominant, even if it be actually subordinate to lateral corrasion.

Between the mountainous region of apparently dominant degradation and the distant region of apparently dominant aggradation there must be a belt or zone where the streams are essentially at grade, the balance between their capacity for transport and the load they carry being here as nearly perfect as conditions will permit. Both downcutting and upbuilding are at a minimum, while lateral corrasion is again dominant, not only in fact but also in appearance. Since the dominant lateral cutting takes place essentially at a constant level, its results are strikingly obvious. Interstream areas are consumed and the valley bottoms coalesce to give a single rock plane sloping in all directions away from the central mountain mass. On this plane the thin veneer of alluvium left by the shifting streams will remain until weathering, sheet floods and wind have disintegrated and removed everything down to bedrock.

It thus appears that in and about each desert range there should normally be found three concentric zones, in all of which lateral corrasion is actually dominant, but in each of which the three processes of degradation, corrasion and aggradation assume such strikingly different relations that each zone in turn appears to be dominated by a different process. (1) In the center is the *zone of degradation,* where vertical downcutting reaches its maximum relative importance. (2) Outside of and surrounding this central area is the *zone of lateral corrasion,* where lateral cutting attains its maximum relative importance. (3) Farther out, and encircling this latter belt, is the *zone of aggradation,* where upbuilding by deposition of alluvium has its maximum relative importance.

Heavily laden streams issuing from the mountain-

[3] G. K. Gilbert, "Geology of the Henry Mountains," 126–133, Washington, 1877.

ous zone of degradation are from time to time deflected against the mountain front. This action, combined with the removal of peripheral portions of interstream divides by lateral corrasion just within the valley mouths, insures a gradual recession of the face or faces of the range. Such recession will be aided by weathering as well as by the rain and rill wash; but it must occur even were these processes of negligible importance. Thus the three zones progressively contract, the central zone of degradation shrinking to smaller and ever smaller size. The zone of lateral corrasion in turn moves inward from all sides, while the zone of aggradation in its turn encroaches upon the smoothly bevelled outer areas of the zone of lateral corrasion. Thus nature provides a beautifully adjusted mechanism which insures that at every point within the initial mountain mass streams will ultimately be maintained at a given level in the balanced or graded condition until the work of planation is complete. Various causes may interrupt the normal cycle of lateral planation, but those will be discussed elsewhere.

Such, it seems to me, is the essence of the theory of lateral corrasion as we may properly deduce it from the initial idea so briefly set forth by Gilbert. If I have expanded his argument beyond the few words in which he stated it, if I have extended its scope beyond the local and restricted conditions to which he applied it, and have deduced far-reaching consequences which find no apparent support in his statements regarding "planation," I hope it will appear that each step in this expansion is logically to be traced back to the fundamental conception which we owe to Gilbert's penetrating mind.

Certainly there are many facts of field evidence which seem most readily to be explained on the theory as here elaborated. The theory implies that under proper conditions we should find occasionally preserved bed-rock surfaces near canyon mouths which possess the form of alluvial fans. Such surfaces have been observed cut in section by waves along the New Zealand coast, and exposed at several places on the flanks of ranges in central New Mexico. Another implication is that neither the bare rock floor nor the alluvial cover is significant of an early or late stage of the process of planation; either may be found in its appropriate zone at any stage of the cycle. In Arizona the rock floor is found about the greatly dissected and much shrunken Sacaton Mountains; in New Mexico at the base of the little dissected Sandias. Outlying erosion remnants of a range should on this theory rise rather abruptly from the inclined rock floor, unless preservation from lateral corrasion for an appreciable time has permitted weathering, rain and rill wash to change the angular contact into a profile more or less rounded. Both angular and rounded contacts are to be observed; but the number of cases in which outlying hills rise sharply from an inclined, thorough-going rock plane, either bare or thinly veneered with alluvium, suggests that lateral corrasion and not weathering is the dominant factor in shaping the topography. On the theory outlined above alluvial fans are normal features in their appropriate zone, even under static conditions, and are not necessarily indicative of faulting, warping, changes of climate or other special causes, as some authorities have suggested. The field evidence seems in harmony with the former, rather than with the latter view.

Faulting, warping, climatic change or simply decrease of stream load due to changes effected by erosion of the central mountain mass, may cause streams to entrench themselves in planes of lateral corrasion. New planes at successively lower levels, and usually with different angles of slope, may be formed. Remnants of such successive planes are common features in arid regions, and beautiful examples have been observed by the writer along the flanks of the Atlas Mountains in Algeria, among the folded mountains of South Africa, in New Zealand, and in our own arid southwest. By projecting the inclined surfaces of this type of outlying mesa remnant upward toward the neighboring range it will often be found that a corresponding surface high in the mountains neatly bevels the disordered structures of the mass. Hence high-level erosion planes on the flanks of mountains should not be accepted as evidence of faulting or uplift of the ranges, nor regarded as incipient pediments the development of which was interrupted by faulting or other disturbance. They may be the inner margins of once vast planes of lateral corrasion, no trace of the distal portions of which have survived the reduction of weaker rock to lower levels. Such high-level benches have been observed by the writer in the Cape Colony ranges, the mountains of the south island of New Zealand, and in various ranges of southern Arizona. They are well developed along the western border of the Southern Rockies north of Santa Fé, New Mexico, while the Rocky Mountain peneplane as observed west of Palmer Lake, Colorado, shows a perfection of planation, a degree of slope, and a sharpness of contact with minor "monadnocks" which lead me to suspect that it should rather be classed as the inner margin of a once far-spreading plane of lateral corrasion.

Fluvial peneplanes should not be confused with planes of lateral corrasion. The former are undulat-

ing rather than plane, grade imperceptibly into the slopes of monadnocks, have imperceptible regional slopes, deep residual soil, no wide-spread alluvial cover, are developed slowly with respect to base level, and are usually trenched by streams only when uplifted. The latter are true planes, exhibit more abrupt and sometimes angular contacts with erosion residuals, present regional slopes commonly obvious to the eye, have little or no residual soil but frequently a wide-spread blanket of alluvium, are developed rapidly without any necessary relation to base level, and may normally be trenched by streams without any change in the attitude or altitude of the areas affected. Peneplane remnants may safely be correlated over fairly broad areas; but planes of lateral corrasion may be developed at so many different levels simultaneously in a single region, or may be developed at the same level at such widely different periods, that correlation of their isolated remnants is both difficult and hazardous.

In the writer's opinion much of the topography widely attributed to eolian denudation by Passarge and others may with good reason be ascribed to lateral planation by intermittent streams. It has not been my good fortune to see typical portions of the Kalahari Desert, but inselberge of the eastern marginal area and other supposed eolian forms pointed out by those familiar with the true desert topography appeared to be capable of more rational explanation as the product of lateral corrasion. This and other aspects of this many-sided problem will receive more adequate treatment in the near future.

SCIENTIFIC EVENTS

RESOLUTIONS ADOPTED BY THE COUNCIL OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE AT CLEVELAND

A Resolution on H. R. Bill 7884, Prohibiting the Use of Dogs for Medical Experimentation in the District of Columbia

(*Unanimously adopted by the Council, December 31, 1930*)

The American Association for the Advancement of Science, which has repeatedly recorded its protest against the enactment of legislation prohibiting animal experimentation for scientific and medical purposes, hereby protests against the passage of House Bill 7884 in the present Congress prohibiting the use of dogs for medical experiment in the District of Columbia.

The circumstances under which this bill was favorably reported, as set forth in the minority report, make abundantly clear that this bill should be recommitted to the Committee on the District of Columbia for full and proper consideration by the members and for adequate presentation of objections by opponents of the bill.

This association is in accord with the practically unanimous and often expressed authoritative voice of science and medicine that animal experimentation has conferred inestimable benefits upon mankind, as well as upon animals themselves, and is essential to the progress of the biological and medical sciences.

The history of medical discovery affords countless examples of the necessity for the use of dogs in certain kinds of experiment, as may be illustrated by the experiments leading to the recent discoveries of insulin in the treatment of diabetes and of liver extract in the treatment of pernicious anaemia.

The conditions under which animal experimentation is conducted in the government and medical laboratories in the District of Columbia afford every safeguard against the infliction of unnecessary suffering upon the animals.

No legislation of the character proposed in this bill has ever been enacted in spite of the efforts of anti-vivisectionists in this country and abroad for many years.

This association, with a membership of over nineteen thousand and representative of all the sciences of nature and of man, is confident that if the members of Congress become fully informed of the injury which would be inflicted upon the progress of curative and preventive medicine by such legislation H. R. Bill 7884 will not receive their favorable consideration.

A Resolution on the Approaching Observance of the Two-Hundredth Anniversary of the Birth of George Washington

(*Adopted by the Council, January 1, 1931*

WHEREAS, The Congress of the United States has created a commission consisting of high officers of the Government and a number of citizens appointed by the President, to arrange a fitting nation-wide observance of the two-hundredth anniversary of the birth of George Washington in 1932, and

WHEREAS, The purpose is to commemorate the life of a man who, in addition to his outstanding achievements in war and peace which were most vital to the creation of the United States of America, had broad interest in every walk of life, including the sciences and the fine arts, as is exemplified by his lifetime active participation in the engineering and science of his day, it is therefore

Resolved, That the council of the American Association for the Advancement of Science does hereby endorse the program of observance of the two-hundredth anniversary of the birth of George Washington, to take place in 1932, and commends to the members of the association their participation in the celebration, and it is further

Resolved, That a copy of this resolution be transmitted to the George Washington Bicentennial Commission, Washington, D. C.

A Resolution on the Need for the Preservation of Redwood Areas in California

(*Adopted by the Council, January 1, 1931*

WHEREAS, full knowledge of biological phenomena such as is required for advance in science and education requires complete protection of primitive associations of plant and animal life, and

WHEREAS, the primitive areas of the coast redwood forest in California constitute some of the most interesting and important life associations, and

WHEREAS, the Save the Redwoods League is vigorously advancing the cause of protection of the coast redwood forest plant and animal associations of California, it is

Resolved, That the council of the American Association for the Advancement of Science expresses its strong approval of the efforts of the Save the Redwoods League and of the State of California to preserve the primitive redwood areas, and respectfully urges that in carrying out this program every effort be made to secure representative areas sufficiently varied to illustrate the various types of forest, and of its associated flora and fauna, and sufficiently large to guarantee for the future the complete protection of these primitive floral and faunal associations.

A Resolution on the Need for the Preservation of Everglades Areas

(*Adopted by the Council, January 1, 1931*)

WHEREAS, the southern end of the Florida peninsula contains biological features of unique character, which are found nowhere else within the area of the United States, and

WHEREAS, it has been proposed to establish a national park for the preservation of these features in their primitive state; therefore the council of the American Association for the Advancement of Science

Approves of the establishment of such a park, but only under conditions that will completely exclude railway and other commercial developments and fully protect the floral and faunal associations within the limits that are to be established.

IN HONOR OF PROFESSOR JAMES EWING

A TESTIMONIAL dinner was given on Saturday, January 31, at the Hotel Pierre in New York City in honor of Dr. James Ewing, president of the medical board and director of cancer research at the Memorial Hospital of New York City. Dr. Ewing has just completed his thirty-second year as professor of pathology in the Cornell University Medical School.

There were four hundred invited guests including those eminent in the field of science from all parts of the country. The toastmaster of the dinner was Dr. George D. Stewart, formerly president of the American College of Surgeons and of the New York Academy of Medicine.

The speakers were: Surgeon General Hugh S. Cumming, of the U. S. Public Health Service; President Livingston Farrand, of Cornell University; Dr. Howard A. Kelly, formerly professor of gynecology at the Johns Hopkins Medical School and now surgeon and radiologist to the Howard Kelly Hospital in Baltimore; Dr. Francis Carter Wood, director of the Crocker Institute of Cancer Research and editor of *The American Journal of Cancer;* Dr. John A. Hartwell, president of the New York Academy of Medicine; Dr. James B. Murphy, member of the Rockefeller Institute for Medical Research; Mr. Archibald Douglas, of the executive committee and board of managers of the Memorial Hospital; Dr. C. C. Little, managing director of the American Society for the Control of Cancer; Mr. Thomas DeBevoise, lawyer; Dr. G. Canby Robinson, dean and director of New York Hospital-Cornell Association, and Dr. Frank E. Adair, attending surgeon, Memorial Hospital.

The January issue of the *Annals of Surgery* was dedicated to Dr. Ewing and published as a tribute to his unique position throughout the world in the field of cancer research. It contained articles from forty-six contributors of international preeminence in this field. At the dinner an illuminated copy of this volume was presented to Dr. Ewing by Dr. Frank E. Adair, who had been associated with Dr. Lewis S. Pilcher, the editor of the *Annals of Surgery,* in editing this special "Ewing Cancer Number."

A letter was received from President Hoover in which he stated: "To the Medical Board of the Memorial Hospital, New York. Gentlemen: I want to thank you warmly for your kind invitation to attend the testimonial dinner in honor of Dr. James Ewing on January 31. I deeply regret that my duties here do not permit me to be present. I should like to share in person in paying honor to such a useful and distinguished citizen, whose work as scientific researcher, teacher and author has done so much to forward the attack on the problem of cancer in particular and of disease in general. Such a career is a service and an inspiration to humanity and deserves the tribute of public praise. Yours faithfully, Herbert Hoover."

A cablegram was sent by Madam Curie as follows: "Congratulations on the well-earned recognition of your important contribution to radiotherapy and your work in the field of cancer." A letter was read from Governor Roosevelt in which he said that Dr. Ewing's achievements in the field of cancer have received national and international recognition and it is a real pleasure to congratulate him upon them as well as upon his invaluable service to the state.

The sentiment expressed at the dinner by the speakers was one of profound admiration for Dr. Ewing, and it was a privilege to pay homage to this unique man in the field of medical science.

B. J. L.

THE NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL AND COLUMBIA UNIVERSITY

THE incorporation in the educational system of Columbia University of the New York Post-Graduate Medical School and Hospital, the oldest institution in the United States engaged solely in the teaching of post-graduate medicine, was announced at the annual dinner of the Post-Graduate Faculty Association held at the Biltmore Hotel on January 31.

The agreement between the two institutions, effective on July 1, 1931, said Dr. Arthur F. Chace, president of the New York Post-Graduate Medical School

and Hospital, makes the Post-Graduate an integral part of the Columbia University teaching system and, in the future, the center of a comprehensive program of post-graduate medical teaching sponsored by the university.

To carry out the program for placing all the post-graduate teaching on a university basis, provision for an interlocking of the governing bodies has been made. Dr. Butler has been elected a member of the corporation and of the board of directors of the New York faculty, which will be under the jurisdiction of the University Council. Other members will be appointed in the near future.

Dr. Chace presided at the dinner. The speakers included Dr. James F. McKernon and Dr. Willard C. Rappleye, the newly elected dean of the College of Physicians and Surgeons.

Among congratulatory letters read at the dinner was one from Dr. Ray Lyman Wilbur, Secretary of the Interior, who is chairman of the Committee on the Cost of Medical Care. Secretary Wilbur said: "I am very much pleased with the opportunity that is opening for continuous educational facilities for the practitioner in the State of New York. I have felt for years that it is one of the most important things that could be done for the advance of medicine in this country."

The affiliation, according to Dr. Edward H. Hume, executive vice-president of the school, is a response to a community demand that the medical profession regard itself more fully as the servant of the social order. Dr. Hume believes that "the new opportunity of the Post-Graduate Medical School, with its fifty years of experience in the teaching of the practitioner, and its new university association, is to make available to the medical profession a center of increased power where the practitioner's powers may be renewed, and his practice raised to a higher level." Starting as a secession from a university medical school, and continuing for nearly fifty years as an independent institution, the institution has become once more a member of a university.

THE BRAUN-SCHUCHERT COLLECTION

DR. CHARLES SCHUCHERT, professor emeritus of paleontology at Yale University, has given the Peabody Museum the Fred Braun collection of invertebrate fossils and other objects of natural history. The gift will be known as the Braun-Schuchert Collection.

It required five large motor vans to transport the collection from its storage quarters to Peabody Museum, as the invertebrate fossils alone number almost 100,000 specimens. Besides these fossils, the gift includes a collection of over 3,000 mineral specimens, a large quantity of archeological material, and a conchological collection of about 10,000 specimens.

Fred Braun, who died in 1918, was a dealer in natural history materials, who began his business career in Cincinnati about 1870. In later years he traveled widely in this country and in Europe, visiting most of the localities which had classical collections of fossils, to gather material for sale or exchange. In some places he opened extensive quarries and at one time he employed as many as 20 quarrymen. Throughout his long life as a dealer, it was his ambition to build up a collection of invertebrate fossils that would be second to none, and into this private collection went the majority of the choice specimens that came into his possession. During his declining years, as adversity overtook him, Braun was obliged to sell certain portions of his great collection, but clung to most of it, and kept it together in spite of his distress. Upon his death in 1918, the collection came into the possession of his friend, Mr. G. E. Ashby.

Professor Schuchert, himself a native of Cincinnati, had been acquainted with Braun since his youthful days in that city. Through later visits to Braun after he had moved to Brooklyn, Professor Schuchert came to appreciate the extent of this great collection. For many years he hoped to secure the collection for Yale, and in 1916 attempted to raise the funds for its purchase. Although at the time this proved to be impossible, due to conditions raised by Braun, Professor Schuchert never gave up the hope which he has just brought to reality by privately purchasing the collection to present to the Peabody Museum.

In 1929 the Academy of Natural Sciences of Philadelphia awarded Professor Schuchert the Hayden Memorial Geological Medal, an honor given once in three years for preeminent research in geology, paleontology and related sciences. At commencement last year Yale University conferred upon him the honorary degree of doctor of science. In presenting him for the degree, Professor William Lyon Phelps, as public orator, described him as "one of the most distinguished scientists of Yale, in the front rank of paleontologists, and the world's leading authority on paleo-climatology."

CONFERENCE ON MEDICAL EDUCATION

DR. RAY LYMAN WILBUR, Secretary of the Interior, will deliver the opening address on February 16 at the Palmer House, Chicago, at the first session of the three-day annual congress on medical education, licensure and hospitals called by the council on those subjects of the American Medical Association. Dr. Wilbur is chairman of the council. He will discuss mental health as a national problem, which will be the keynote of three sessions.

State and Federal provision for the care of the mentally ill will be discussed by Dr. Walter L. Treadway, assistant surgeon general of the United States Public Health Service, and Dr. Samuel W. Hamilton, of White Plains, New York; Dr. Allen Jackson, of Danville, Pennsylvania; Dr. George S. Stevenson, of the National Committee for Mental Hygiene, New York, and Dr. Lawson G. Lowrey, director of the Institute for Child Guidance, New York, will speak on the mental hygiene movement.

Dr. Clarence M. Hincks, director of national committees for mental hygiene in the United States and Canada, will describe the work of the organizations. The relationship of mental health to medical education will be discussed by Dr. Franklin G. Ebaugh, of Denver; Dr. C. Macfie Campbell, of Boston, and Dr. H. Douglas Singer, of Chicago.

Among those who will speak on the licensing of physicians to practice medicine at a meeting of the Federation of State Medical Boards in conjunction with the congress will be Sol Ullman, Deputy Attorney General of New York State. Mr. Ullman will talk on the control of unlicensed practitioners. Dr. Frederick C. Warnshuis, of Detroit, will speak on "Who Shall Be Permitted to Continue the Practice of Medicine?" Other speakers on kindred topics will be Drs. William Jepson, of Sioux City, Iowa; Walter F. Donaldson, of Pittsburgh, and H. M. Platter, of Columbus, Ohio.

Four sessions of the congress will be devoted to various problems in the teaching of medicine. The speakers will include Dr. Charles P. Emerson, Dean of the Indiana University School of Medicine, Indianapolis; Dr. Wilburt C. Davison, Dean of Duke University School of Medicine, Durham, N. C.; Dr. Willard C. Rappleye, newly appointed Dean of Columbia University College of Physicians and Surgeons; Dr. William J. Mayo, of Rochester, Minnesota; Dr. Clifford C. Grulee, of Chicago, and Dr. James S. McLester, of Birmingham, Alabama.

The training of internes, hospitals and the law, and special facilities for caring for convalescents will be discussed at three sessions.

MEETING OF GEOLOGISTS AT TORONTO

THE forty-third annual meeting of the Geological Society of America and its affiliated societies, the Paleontological Society and the Mineralogical Society of America, was held at the University of Toronto, on December 29, 30 and 31.

The meeting was one of the largest in the history of the society, 519 persons being registered. Ninety-six scientific papers were presented before the Geological Society, and the programs of the affiliated societies were also crowded.

The address of the retiring president, Dr. R. A. F. Penrose, Jr., "Geology as an Agent in Human Welfare," was delivered the evening of December 29 at the Royal York Hotel, and was followed by a special entertainment provided by the Toronto hosts. The annual dinner was held in the Great Hall of Hart House at the university, on the thirtieth. The third award of the Penrose Medal of the Geological Society of America was made at the annual dinner, the medal being accepted by M. Rochereau de le Sablière, French consul at Toronto, in the absence of the recipient, Professor François Antoine Alfred Lacroix, of the Natural History Museum, Paris.

The officers of the society for the year 1931 are:

President—Alfred C. Lane.
Vice-presidents—Thomas L. Walker, Henry B. Kummel, Edgar R. Cumings, Alexander H. Phillips.
Secretary—Charles P. Berkey.
Treasurer—Edward B. Mathews.
Editor—Joseph Stanley-Brown.
Councilors—Herdman F. Cleland, Elwood S. Moore, W. C. Mendenhall, W. J. Mead, Sidney Powers, Donnel F. Hewett.
Representative of the Cordilleran Section—Eliot Blackwelder.

Announcement was made of the election of 28 new fellows and five additional foreign correspondents.

SCIENTIFIC NOTES AND NEWS

DR. WILLIAM H. WELCH was the guest of honor at a dinner at the Maryland Club, Baltimore, on January 29, at which a specially bound copy of a memorial volume, recounting the world-wide celebration of his eightieth birthday, was presented by Mr. John D. Rockefeller, Jr. The book is titled "William Henry Welch at Eighty" and contains the special inscription: "Dr. Welch, this is the first copy of a book which has been made for remembrance. It is a token of affection from friends who desire that posterity may read the story of the day when you were eighty." Dr. William G. MacCallum presented Dr. Welch with a specially designed scrap-book containing more than 3,000 clippings of press notices about the eightieth birthday celebration. Dr. William H. Howell presented a volume bearing congratulatory messages. Mr. John A. Kingsbury, secretary of the Milbank Memorial Fund, presented a volume which contained tributes to Dr. Welch from universities and societies of medicine all over the world. Dr. Simon Flexner presided. Reports of the celebrations in honor of Dr. Welch's eightieth birthday on April 8 and subse-

quently have been printed in SCIENCE, including the address made in Washington by President Hoover and Dr. Welch's reply.

THE new laboratory building to be constructed at the Scripps Institution of Oceanography of the University of California will be known as William E. Ritter Hall, in honor of Professor Emeritus Ritter, who was chiefly concerned with the station's founding and who was its first director. The plans call for a building two stories in height with an additional basement floor, and 46 by 100 in floor area, to be erected at a cost of $120,000. Space is to be allotted for laboratories of dynamical oceanography and marine meteorology, chemistry, marine bacteriology and the physiology of marine organisms.

A PORTRAIT of Professor Harry Burr Ferris, for forty years a teacher of anatomy in Yale University, has been presented to the Yale School of Medicine by a group of his former students and colleagues, of whom 631 participated in making the gift. The portrait is the work of John Quincy Adams, of Vienna. It will hang in the Ferris room, a library and seminar room for the use of students of anatomy, as a permanent tribute to the esteem and affection in which Professor Ferris is held. Professor Ferris in 1897 was appointed E. K. Hunt professor of anatomy, a chair which he has filled since that date.

AT the annual banquet of the New York State Veterinarians Dr. Veranus A. Moore, until his recent retirement director of the New York State Veterinary College and state veterinarian of New York, was presented with the honorary diploma conferred last summer by the International Veterinary Congress at London. The presentation was made by Dr. John R. Mohler, chief of the United States Bureau of Animal Husbandry. Dr. Moore is now one of the two honorary members in America of the Royal College of Veterinary Surgeons. Dean Pierre A. Fish presided at the dinner.

A UNITED PRESS dispatch reports that the Pasteur Institute in Paris has dedicated a bronze monument to M. Joseph Meister. Meister, as a boy, forty-five years ago, was the first person to allow M. Pasteur to inoculate him with the rabies serum. The statue commemorating the event shows the farm boy grappling with a mad dog. M. Meister is now living in Paris.

DR. KARL LANDSTEINER, a member of the Rockefeller Institute for Medical Research, has been elected an honorary member of the Royal Swedish Academy of Science.

THE Council of the Geological Society of London has this year made the following awards: The Wollaston Medal to Dr. Austin Williams Rogers, of the Geological Survey of the Union of South Africa, in recognition of the value of his work on the geology of South Africa. The Murchison Medal to Dr. George Walter Tyrrell, of the University of Glasgow, for his work on the igneous rocks of the West of Scotland. The Lyell Medal to Mr. Ernest Clayton Andrews, of the Geological Survey of New South Wales, for his researches on the economic geology of New South Wales and on physical geology. The Bigsby Medal to Dr. Norman L. Bowen, of the Geophysical Laboratory, Carnegie Institution, Washington, D. C., in recognition of the value of his researches on the physical chemistry of igneous rocks. The Wollaston Fund to Dr. Robert G. S. Hudson, for his work on the stratigraphy and paleontology of the carboniferous rocks of Yorkshire. The Murchison Fund to Dr. Cyril James Stubblefield, for his researches on the Cambrian rocks of Shropshire and on invertebrate paleontology. A moiety of the Lyell Fund to Dr. Oliver M. B. Bulman, in recognition of his work on the Cambrian rocks of Shropshire and of his paleontological researches. A second moiety of the Lyell Fund to Mr. William Howson Wilcockson, for his work on petrology and economic geology.

OFFICERS of the Washington Academy of Sciences have been elected as follows: *President,* N. A. Cobb; *Resident Vice-presidents,* J. M. Cooper, Walter Hough, L. A. Rogers, Alexander Wetmore, H. B. Humphreys, R. E. Gibson, Paul Bartsch, A. C. Clark, H. L. Whittemore, H. C. Macatee, C. H. Birdseye, H. L. Curtis, G. W. Vinal, W. E. Parker, Harold Morrison, F. C. Craighead, F. V. Coville, G. R. Mansfield; *Non-resident Vice-presidents,* Cyrus Adler, W. D. Coolidge; *Corresponding Secretary,* Paul E. Howe; *Recording Secretary,* Charles Thom; *Treasurer,* H. G. Avers; *Managers for the term of three years ending 1934,* N. M. Judd, L. B. Tuckerman.

DR. WM. CHARLES WHITE was elected president of the Cosmos Club, Washington, at the annual meeting of the club in January.

FOLLOWING the annual meeting of the American Institute of Consulting Engineers, held in New York on January 19, the council re-elected Colonel Frederic A. Molitor as president, and Philip W. Henry as secretary and treasurer. Robert Spurr Weston, of Boston, was elected vice-president, and Colonel Molitor, Mr. Weston and F. A. Burdett as the executive committee. The committee on admissions comprises G. A. Orrok, H. R. Buck, of Hartford, Connecticut, and F. C. Noble.

DR. HARLAN T. STETSON, professor of astronomy at the Ohio Wesleyan University and director of Perkins Observatory at Delaware, Ohio, has been appointed non-resident lecturer in the Graduate School of the

Ohio State University. This is in accordance with the plan approved by the trustees of both the Ohio Wesleyan and the Ohio State University for the cooperative graduate program in astronomy and astrophysics, whereby graduate students of the State University may carry on research work for advanced degrees at the Perkins Observatory.

DR. FLOYD K. RICHTMYER, professor of physics at Cornell University since 1918, has been elected dean of the Graduate School by the trustees. Professor Richtmyer succeeds Dean Rollins A. Emerson. He took up his new work on February 6.

DR. CHARLES KEPHART SWARTZ, collegiate professor of geology in the Johns Hopkins University, will retire at the end of the academic year.

DR. GEORGE J. HEUER, surgical director of the Cincinnati General Hospital and Holmes professor of surgery in the University of Cincinnati College of Medicine, has been appointed surgeon-in-chief of the New York Hospital and professor of surgery in Cornell University, to be effective July 1. He will remain in Cincinnati until that time, when he will undertake the organization of the surgical department in the new building of the New York Hospital-Cornell Medical College Association.

GEORGE E. MARVIN, instructor in the department of entomology at the Wisconsin College of Agriculture, has tendered his resignation, to accept a position with the new bee-culture laboratory in the Bureau of Entomology of the U. S. Department of Agriculture.

GEO. P. GRAY, formerly chief of the Division of Chemistry of the California State Department of Agriculture, has been named director of the California Soil Improvement Committee and assumed his new work on January 1.

DR. W. S. LEATHERS, dean of the Vanderbilt University Medical School, has been appointed a member of the National Advisory Health Council of the Federal Public Health Service.

DR. W. HEITLER, of the University of Göttingen, will be in residence at the Ohio State University during the spring quarter as visiting professor of theoretical physics. He will lecture on "The Quantum Theory of Valence and Related Phenomena." Professor Raymond T. Birge, of the University of California, and Professor John S. Foster, of McGill University, have been appointed to special lectureships for the summer quarter of 1931. Professor Birge will lecture on band spectra and Professor Foster on the Zeeman effect, Stark effect and related topics.

DR. R. A. FISHER, chief statistician of Rothamsted Experimental Station, Harpenden, England, will spend eight weeks in the United States during the coming summer. He will be in residence on the staff at the Iowa State College during the first half of the summer session, from June 16 to July 24 and later will visit a number of colleges, universities and experiment stations throughout the country. In connection with Dr. Fisher's visit, the Iowa State College announces a special group of summer session courses covering the theory and application of statistics.

DR. ERNEST LITTLE, dean of the New Jersey College of Pharmacy of Rutgers University, sailed for Genoa on February 3. Dr. Little, who is on an eight months' leave of absence from the college, will spend much of his time in the Medical Chemical Institute of the University of Graz. He also expects to visit several other universities and scientific institutions that are doing work which is of especial interest in the fields of pharmacy and medicine.

PROFESSOR MALCOLM H. SOULE, of the Hygienic Laboratory of the University of Michigan, is spending the winter quarter in special research at the School of Tropical Medicine, San Juan, Porto Rico. He will give a series of lectures to the faculty and students while in residence. Professor Ernest Carroll Faust, of Tulane Medical School, will spend two weeks at the school during the present month and is giving a series of lectures during his visit.

PROFESSOR R. A. MILLIKAN, of the California Institute of Technology, recently lectured at Amherst College on "Exploring the Universe." On January 23 Mr. John Bellamy Taylor, consulting engineer for the General Electric Company, gave a lecture on "Audible Light."

DR. AUSTIN F. ROGERS, of Stanford University, gave an illustrated lecture on the silica minerals before faculty and student members of the department of geology of the University of Arizona on January 7.

THE annual lecture and address to the initiates before the University of Michigan Chapter of the Society of Sigma Xi will be delivered by Herbert F. Moore, research professor of engineering materials of the University of Illinois.

DR. E. M. EAST, of Harvard University, will deliver the fifth Harvey Society Lecture at the New York Academy of Medicine, on Thursday, February 19. His subject will be "Possible Immunological Reactions with Plants."

DR. HENRY NORRIS RUSSELL, professor of astronomy at Princeton University, is giving in Boston a course of six Lowell Lectures on "The Physics of the Stars."

THE thirty-sixth general meeting of the German Bunsen Society for applied physical chemistry will take place from May 25 to 27 in Vienna. The subject of the symposium will be: "Recent Progress in the Science of Metallurgy with Particular Reference to Light Metals." The arrangements have been undertaken by Professor Dr. Specketer.

THE School of Tropical Medicine, San Juan, has received a grant of $36,000, extending over a period of four years for the study of nutrition in Porto Rico. The work was begun on January 1 and will be under the direction of Professor Henry C. Sherman, of Columbia University.

MR. DAVID E. ROSS, president of the board of trustees of Purdue University, has purchased and deeded to the university three tracts of land, 157 acres in all, to be developed as the Purdue Airport. The tracts of land are level and without trees. They lie half a mile southwest of the campus and adjoin Edgewood farm, owned and operated by the university, which could be used as part of the landing field, in case this were found desirable at a later date, giving a combined tract of 317 acres of level land.

THAT the present name of the Massachusetts Agricultural College is a misnomer in that it applies to only one part of the college was the main point in the argument presented by a committee of the trustees to the state legislative committee on education at the State House on January 28, in support of the petition of George H. Ellis, vice-president of the trustees, to change the name of the college to the Massachusetts State College. Mr. Ellis stated that the action would involve no change in the purpose or scope of the college. There was no opposition.

BARON HARINXMA, accompanied by Dr. G. A. Brouwer, the biologist of the Natural History Museum of Leiden, Holland, has set out from Addis Abeba, Abyssinia, at the head of an expedition which will traverse some of the wildest portions of the African continent. The expedition, which is composed of twenty men, transported by forty mules and three camels, will proceed through the Great Rift Valley to Lake Rudolph. The party will make a careful study of the fauna of the region through which it passes and hopes to secure many photographs of the wild animal and bird life which abounds in the districts to be visited. After leaving the Ethiopian frontier in the vicinity of Lake Rudolph the expedition will go to Movale in the northern frontier district of Kenya, thence to Meru, British East Africa, either by way of Marsabit, or the more eastern route of the Lorian swamps.

AN Associated Press dispatch reports that plans for four Russian Arctic expeditions have been completed by the All-Union Institute of the North. The first will leave Archangel for Vladivostok to search for the supposed Andreyev Land, believed to exist between Wrangel Island and the islands north of Siberia. So far as known this part of the Arctic has never been visited. The expeditions will travel on an ice breaker and carry an airplane for scouting. A second expedition will go to Franz Josef Land to replace workers at the meteorological station and carry on further scientific work. A third group will investigate the natural resources of the Chukotsky Peninsula, Siberia. The fourth will search for huge deposits of coal reported in the Khoradlaksk Mountain Ridge north of the Lenz River.

SECRETARY OF AGRICULTURE HYDE has received from the American Association of Economic Entomologists formal notification of resolutions which the organization adopted at its annual meeting in Cleveland, December 29 to January 1. The resolutions were as follows:

WHEREAS, The establishment of the Mediterranean Fruit Fly in Florida constituted a great menace to the horticultural industries of the South and West, and,

WHEREAS, The campaign to eradicate this pest has accomplished results far beyond our expectations, and,

WHEREAS, This campaign is one of the outstanding achievements in the annals of economic entomology; be it therefore

Resolved, That the American Association of Economic Entomologists here assembled extends to the Plant Quarantine and Control Administration of the United States Department of Agriculture and to the State Plant Board of Florida its congratulations on the great work accomplished to date; and be it further

Resolved, That a copy of this resolution be forwarded to the President of the United States, the Secretary of Agriculture, the Governor of Florida, and to the officials of organizations involved.

THE Berlin correspondent of the *Journal* of the American Medical Association states that the German Federal Health Council received information in December in regard to the investigations carried out in the federal bureau of health and in the Robert Koch institute in Berlin, in the Deutsche Forschungsanstalt für Tuberkulose in Hamburg, and in the pathologic institute of the University of Berlin, on the regrettable occurrences in Lübeck. The report of Professor Ludwig Lange, of the federal bureau of health, in which Professor Neufeldt, of Berlin, and Dr. Kirchner, of Hamburg, concurred, expresses the following conclusions: (1) The illnesses and deaths of infants that occurred in Lübeck following the Calmette vaccination against tuberculosis were not due to the Calmette procedure as such. (2) The assumption that in Lübeck a mixing of virulent tubercle bacilli with the Calmette cultures occurred as a result of an unrecognized error of manipulation appears extremely probable. After careful deliberation, the federal health council upholds the decision reached in 1927 to the effect that the ques-

tion of immunization against tuberculosis in man is so imperfectly elucidated by the experimental and statistical observations that a general application of such immunization (particularly when living bacilli are employed, even though in an attenuated form) appears ill advised, for the present. In order to prevent in the future such occurrences as took place in Lübeck, the federal health council regards as essential an extension and accentuation of the legal requirements with respect to the preparation, distribution and use of vaccines of all kinds. A commission was appointed charged with the duty of submitting to the federal health council suitable proposals, as soon as possible. With this decision, which brings no surprises, the investigation, from the scientific point of view, is brought to a close. It remains only for the courts now to give their decision. From the existing material, it may, to be sure, appear doubtful whether the courts will reach any definite results.

THE American Society for the Study of Disorders of Speech has entered on a nationwide cooperative study of the treatment of stammering. Twenty-eight specialists from all parts of the United States presented papers on the principles of treatment of stammering at the annual convention of the society held in Chicago on December 30 and 31 and January 1. The papers read at this convention are to be mimeographed and turned back into the hands of each participant on the program and to attendants at the convention and their students and associates (but not to the public) for a year of analytic study, when another series of papers on treatment will be presented at the annual convention to be held next December in Detroit. A committee was appointed to publish an abridgement of these papers for the public. Provision was also made at this convention for the appointment of both an executive committee and an advisory committee on study and research into the treatment of stammering. The executive committee will consist of the members of the council of the society. The advisory committee has not yet been appointed. After this study has reached a sufficient degree of clearness, it is intended to carry out definite plans of research aimed to determine the relative efficiency of such conceptions of treatment as seem to be most worth while. This study will consume a number of years, and should prove to be very valuable.

FOR the past two years, the Association of American Medical Colleges has been making a check-up on the work done by the freshmen in the medical colleges in membership in the association. The purpose of this work is to encourage cooperation on the part of the institutions in which these students have done their premedical work. Complete records are obtained on each student who did not carry on his medical studies in the medical school which is a part of the institution in which this premedical work was done because related institutions are usually supplied with this information of the performance of their own students. Unrelated institutions have not up to the present time had any way of ascertaining the character of the work done by their premedical students who have studied medicine in medical schools other than their own. It is planned to send out these reports to colleges of liberal arts and science, but the expense involved has made it impossible to complete the task. Any college or university desiring information on its premedical students can obtain it by writing to the secretary of the association, Dr. Fred C. Zapffe, 25 East Washington Street, Chicago. During the years that this study has been carried on, the freshmen entering medical colleges have come from approximately 650 colleges of liberal arts and science. About one half (3,250) of the matriculants of each year have come from unrelated institutions.

THE Paris correspondent of the *Journal* of the American Medical Association writes that the question of public health in the French colonies is vital as regards not only the European colonists but also the natives. The mortality of the natives from disease, in connection with such undertakings as the building of railways and the digging of canals, tends to diminish the local labor supply; and the child mortality, which remains high, is gradually depopulating the country and preparing the way for an invasion by more hardy or better educated races. An endeavor has been made to develop medical facilities for the natives, including dispensaries, and laboratories for the preparation of vaccines, and, finally, to introduce a more rational diet. The natives are nearly always underfed, contenting themselves with fruits and roots. The number of colonial physicians has been considerably augmented, but an adequate number can not be secured without offering attractive salaries, which have thus far not been forthcoming. The creation of schools of colonial medicine at Bordeaux and at Marseilles and of a special institute at Paris for the study of parasites and tropical microorganisms has completed the vast program. For the past ten years, the budgets of public health for each colong have been regularly augmented: on the Congo and in Cameroons, Indo-China, Madagascar, French West Africa, and especially in French Equatorial Africa, where the native mortality is the highest. The sum of $12,000,000 has been provided for the first three colonies, $1,680,000 for French West Africa, $2,400,000 for Madagascar, and $3,000,000 for French Equatorial Africa.

DISCUSSION

EVIDENCE OF A LOWER LEVEL OF LAKE SUPERIOR

EARLY this fall a sample of peat was sent to the writer for pollen analysis. It had been dredged up from a depth of 54 feet below the surface of Lake Superior, about one and one half miles west of Sand Island, Bayfield County, Wisconsin. According to Professor J. A. Merrill, of the Superior State Teachers College, the deposit is in 40 feet of water and under 14 feet of lake sand, covers a considerable area, and is *in situ*. Another deposit is reported between Cat Island and North Twin Island, about 23 miles east northeast of Sand Island.

These two peat deposits would indicate a lake level at least 54 feet below the present level, which is not in accordance with our present ideas concerning the postglacial history of the region.[1] The unaltered state of the peat would strongly suggest that it was not of interglacial age, but postglacial, and probably associated with the Nipissing Stage of the Great Lakes.

Examination of the peat shows it to be remarkably well preserved. It is well stratified, and separates in layers when soaked in warm water. Several plant tissues are recognizable without special treatment of the peat. These are *Sphagnum*, leather leaf (*Chamaedaphne calyculata*) leaves, balsam fir (*Abies balsamea*) cone scales, and *Carex* achenes and rootstocks. The pollens in the peat are also well preserved, and are those of plants found in and near a typical northern peat bog. Spruce pollen is the most abundant form, and *Sphagnum* spores are second in abundance. Pollens of birch, heaths, sedge, willow, and several composites have been observed, but only tentatively identified. Numerous dark-colored spores of fungi also have been found. Besides many unknown pollens and spores, there occur a few fragmentary parts of small insects.

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THE STRUCTURE OF SOME INDUSTRIAL DIAMONDS

THE catalog of a large European dealer in diamonds used for industrial purposes contains the interesting information as to the relative structure and hardness of several different forms in which carbon is found in nature. Diamonds for industrial uses are classified into *carbons* (carbonado, black Brazilian diamonds), *ballas*,[1] and *boarts* (borts), which they describe as follows:

Boarts are more or less transparent crystals, of bright appearance occurring in the most varied shapes, and sometimes in twin and multiple crystal formation—Brazilian boarts rank first in point of hardness, followed in approximate order of merit by Australian, South West African and Cape.

Carbons (or carbonados) differ essentially from boarts in their structure. They are often described as amorphous diamonds, but really consist of microscopically small dark octahedrons, and are, consequently, a porous cluster of minute diamond crystals, fine to close-grained. The fracture of a good carbon should resemble the structure of fine steel. Not being built up in countless thin layers, they are much less fragile than boarts and unlike the latter, can be used until entirely consumed. The intense hardness of carbons is extraordinary, and considerably exceeds that of boarts.

Ballas are comparatively rare, and are found in South Africa and Brazil. They are non-porous, mostly roundish in shape, and consist of innumerable, well-formed, minute crystals grouped in concentric formation around a nucleus. On account of their structure, they have no defined cleavage planes, and are, invariably, of extraordinary hardness. Strictly speaking, they are not harder than the best carbons, but tougher on account of their structure. Round white diamonds are often wrongly described as ballas, but these are merely boarts of round shape, which being easily cleaved, can in no wise be used in place of ballas.

Brazilian ballas is used to test the hardness of carbons. When the two are rubbed together, a white mark indicates that the carbon is harder, while a dark-brown mark indicates the carbon is harder. Where both stones are of equal hardness, *no* mark results on either.

These facts seemed to indicate that, as is the case with steels, the hardness is greatly influenced by grain size.[2] The American representatives of the dealers kindly loaned me a small ballas and two pieces of carbon, one very hard, the other softer. About two years ago Professor George L. Clark was good enough to take x-ray spectrograms of the three specimens. The results indicate that the ballas was composed of a great number of small crystals, the softer carbon of smaller and more numerous crystals, while in the harder carbon many of the crystals were approximately of colloidal dimensions, the rings of the x-ray spectrogram being continuous, with many small spots.

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[1] Frank Leverett, "Moraines and Shore Lines of the Lake Superior Region." U. S. Geol. Sur. Prof. Paper 154–A (1929).

[1] The word "ballas" has not been found in any dictionary consulted, but seems to be a modified form of the Portugese *balas* meaning *bullets*. The Spanish and Portugese word *bola* means ball, whence is derived the Argentine *bolas* used much as our lasso. Through the Latin *ballista*, the word goes back to the Greek βαλλειν, meaning to throw. Palla is an Old German form, and the golden balls of the house of Medici, now used by pawn-brokers, were known as *pallé*, which was the rallying cry of the Medicis.

[2] Samples of ballas and carbon were exhibited before the American Institute of Mining and Metallurgical Engineers in the course of a discussion. See *Trans.*, Vol. C, 29 (1929).

In J. W. Mellor's monumental book, Vol. V, p. 720 (1924), it is stated: "Boart and carbonado are usually regarded as forms intermediate between diamond and graphite." But the photographs indicate that the crystalline form throughout is that of diamond, the differences in hardness being primarily consequent on variations in the structure and particle size of the aggregates.

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BACTERIAL STEM-ROT DISEASE OF HYBRID SEEDLING CANES

IN October, 1930, a bacterial stem-rot disease of hybrid seedlings canes appeared sporadically in the cane culture of the College of Agriculture at Los Baños, Laguna, Philippine Islands. Later the same disease was observed on hybrid canes in the sugar cane plantation of the Calamba Sugar State at Canlubang, Laguna, and in the sugar cane plantation of the Pampanga Sugar Development Company at Del Carmen, Pampanga. Affected plants show pale yellow color on the foliage followed by wilting of the entire plant. When weather conditions favor, the tops of the diseased plants fall over as a result of the rotting of the tender tissues of the shoot.

Microscopic examination of diseased plants showed the presence of abundant motile bacteria between the cells in the young stages and within the cells in advanced stages. The vascular tissues are apparently free from the bacterial invasion.

The bacterium has been isolated and grown in pure culture. Inoculation of healthy plants with the pure culture of the bacterium reproduced the disease. The organism is of the genus *Bacillus* Cohn., since peritrichiate flagella are demonstrated by proper staining methods. The causal bacterium is a cylindrical rod with more or less rounded ends. The cells occur singly or in pairs, occasionally in chains, and in clumps in 24 to 48-hour-old culture. Films prepared from the juice of infected canes and stained with aniline gentian violet gave measurements of the cells from 0.95 to 2.2 by 0.5 to 0.7 μ. Spores are not formed. Thin capsules are formed in three-day-old nutrient agar slants. The cells are motile by means of peritrichic flagella numbering from four to several. No involution forms were observed in one-month-old fluid cultures. The bacterium is gram negative and non-acid fast. No such species of bacteria has been reported heretofore as the cause of a stem rot of sugar cane. A more detailed description of the disease and the bacillus is in preparation.

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THE FOUCAULT EXPERIMENT

IN connection with certain studies related to the relativity theory it has occurred to the writer that it might be interesting to repeat the famous Foucault pendulum experiment on a large scale, over a long period of time of perhaps a year or more, and under carefully prepared conditions.

To do so would, of course, require a suitable place and the solution of a number of problems associated with its construction, continuing its motion without affecting its direction, precision of measurement, and others which occur with contemplation. With a pendulum length of 100 feet, for example, rotational motion with a period of more than 2,000 years should be easily detectable over a length of time of a year.

This experiment, if thus carefully performed might reveal or disprove some very intriguing speculative possibilities. It is rather fruitless to outline them but it would seem that a plane of motion for the pendulum perpendicular to the direction of the sun at the earth's perihelion would be a good place to start.

The writer is seriously considering undertaking the task and would be much interested to see opinion, criticism, or suggestion.

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SCIENTIFIC BOOKS

A History of Applied Entomology (Somewhat Anecdotal). By L. O. HOWARD. Smithsonian Miscellaneous Collections, vol. 84. Washington: Nov. 29, 1930. 564 pp., 51 plates (portraits).

> For the fly, the fly, the fly is on the turmit,
> And it's all me eye, for we to try
> To get fly off the turmit.—*Old Oxfordshire Ballad.*

The intelligence of the human race, *if brought to bear*, will conquer the insect menace.—*L. O. Howard*, 1930.

IT is probably no exaggeration to say that many thousands of people, at the present time, owe their lives to the work of the entomologists. The greatly increased population of nearly all civilized countries could not be supported without a correspondingly increased food supply, and this we owe in large part to those who have taught us how to defend ourselves against the attacks of insects. Thus, to give a concrete example, there is no orange-grower in California who doubts that his crop would be entirely ruined, were it left to the insects which prey upon it. Within a few years, at most, he would have to go out of busi-

ness, and a product worth about a hundred million dollars a year would have practically ceased to exist. In the discussions concerning the Mediterranean fruit fly, it has not been clearly brought out, but is undoubtedly a fact that it would pay California to spend a million dollars to keep that insect out one year. Not only the enormously increased acreage under cultivation, but the spread of injurious insects from one country to another and the frequent absence of their natural enemies have favored the inordinate increase of many kinds of insects which were formerly harmless. New situations are continually arising in various parts of the world which threaten the prosperity and even the livelihood of whole populations. Not only are the crops attacked, but man and his domestic animals suffer from many diseases which are transmitted through the agency of insects. Malaria, bubonic plague, sleeping sickness, typhus and yellow fever are all transmitted through the bites of insects. Even in warfare it has often been found that insects were the principal enemies, more destructive than the bullets of the opposing army.

I am old enough to remember very well the discoveries of the mode of transmission of malaria and yellow fever, the arrival in America of many pests now prominent, the constantly increasing dangers from insect attack, and the development of means for resistance. As I think of it, we have suffered much from our ignorance and incapacity, from our unwillingness to learn and our lack of organization and cooperation. Yet after all great progress has been made, and the development of the subject, in all its ramifications, is sufficient to amaze those who understand it. Whatever our errors and faults, it still remains true that the work of the entomologists has made possible the existence of great numbers of people for whom, otherwise, there would have been no sustenance, or who would have perished from disease. I said above, many thousands, but doubtless many millions are involved. But in matters of this sort mere statistics are wholly inadequate.

Such a movement, having such great results, deserves to be recorded as history. The ordinary historians know nothing of it, nor are they competent to deal with it had they the wish. Few there are, indeed, who can view it in a comprehensive and intelligent way, and describe it interestingly. Of all men, it was obvious that Dr. L. O. Howard was the best fitted for this undertaking. We may rejoice that his retirement from executive duties has not meant idleness, but fruitful work, the first product of which has just been published by the Smithsonian. It is a history and description of economic entomology, based primarily on the knowledge and experience gained through many years of service: but also, when necessary, compiled from many sources, published and unpublished. It is not, indeed, a perfectly balanced history of the subject, such as may some day be written, because it deals especially with matters familiar to the author. Yet no man has had such wide experience, abroad as well as in America, and nothing could be more appropriate than the description of this experience for us and posterity. Through it, we get the best possible understanding of the essential facts, just as we understand a country better from the well written account of a traveller who has passed through it, than from a portly volume of data on topographical features, populations, trade statistics and the like.

The first part (198 pp.) deals with applied entomology in North America. The second part (138 pp.) describes the work in Europe. Other sections relate to Asia, Africa, Australasia and the Pacific, South and Central America and the West Indies, and medical entomology. The extremely interesting series of portraits includes European celebrities of the seventeenth and eighteenth centuries, fifty-five United States entomologists (three of them women), five from Canada, five from Mexico, and many from other countries. Plate 39 shows five men who are working or have worked in the Hawaiian Islands. In his treatment of the United States, Howard omits the portraits of all the younger men, and very many of them are not even mentioned. He also gives little information concerning the work of many of the experiment stations and other local institutions. On the other hand, the data concerning foreign countries are as complete as it was practicable to make them, and the work of the younger generation is very fully described. Due apologies are made for this onesidedness, and we can readily understand that it was impossible to fully describe all the work going on in different parts of North America without spending additional years and producing another large volume. We in this country may well feel grateful for so much concerning men and measures abroad; but there is a certain danger, very frankly recognized by the author, that foreigners may not adequately appreciate the work of the United States. Thus such books as the "History of Entomology in California," which is being written by Professor Essig, will have their appropriate and very useful place.

In another respect we notice a certain lack of balance, which we have little inclination to criticize adversely. In discussing the events of the past century, and men who have long ago departed from the stage, good and evil are set forth with sufficient frankness to bring out the difficulties and conflicting purposes which so often hindered progress. This was necessary in the interests of historical accuracy, and seems in no case to suggest malice. The very serious faults of C.

V. Riley, Howard's predecessor in office, were well known to all the older men now living, but here they are first clearly described in print. At the same time, no less clearly and emphatically, we are told of the really great things accomplished by Riley, so that when all is said we must recognize him as a potent factor in the development of modern economic entomology. He was the victim of a peculiar temperament, and of political influences which surrounded him, but he had his vision, and was a man of outstanding ability and sagacity. In all these matters, we are inclined to compare him (except as to the politics) with another great naturalist, E. D. Cope.

But to come back to the alleged lack of balance; it consists in this, that whereas long past events are frankly described, all care is taken to avoid hurting the feelings of those now living. Thus the unsophisticated reader might imagine that whereas in the past there was the devil to pay, now virtue, industry and intelligence reign supreme. Who can regret this reticence? Any other course would have been impossible, though I must confess that there are some optimistic passages which I should have omitted. As a matter of fact, while we still have to regret some of the attributes of *Homo sapiens,* it is perfectly true that on the whole the face of things has vastly improved. For one thing, good traditions have been established, which will not readily be broken. Thus heads of departments do not, to-day, coolly appropriate without acknowledgment the work of those under them. Often the tendency is all the other way, and subordinates or students are allowed to publish work which owes its inspiration and much of its originality to those directing them. Crass political influence is not so rampant as it was, and as a rule scientific men have little to fear from it. The public treatment and recognition of entomologists has greatly improved. Public opinion, formed through association in numerous societies, controls the actions of scientific workers so subtly that younger men, coming to the front, would never even think of doing things which once were not uncommon. In short, we are yearly becoming more socialized, and more responsible to one another. In a manner, virtue is forced upon us; or we would prefer to say, our virtues are cultivated rather than our vices.

One very happy movement in which Dr. Howard has had a most prominent part is that for international cooperation in economic entomology. Through many hard experiences, the country has learned that the United States can not live alone in these matters. It seems grotesque that there was once great difficulty in arranging to send a man abroad to study the natural enemies of the cottony cushion scale. Now we maintain laboratories abroad, and it is considered natural and proper that our government entomologists should cooperate in every possible way with those of other countries. It was an occasion for rejoicing when a minute parasite sent from Washington to Italy brought under control one of the most dangerous scale insects of that country. One could wish that politicians and publicists in general might study the international policies initiated and developed by Howard, and become converted to the advocacy of like measures in respect to other affairs. Were this possible, the world would be a much better place to live in.

Special acknowledgment is made in the introduction to the Imperial Bureau (now the Imperial Institute) of Entomology in London and its director, Sir Guy Marshall. This organization serves the whole British Empire, and has attained an extraordinary degree of efficiency. I myself am indebted to it for most of my knowledge concerning the insects obtained during my journeys abroad. Hundreds of these insects, mounted, labelled and named, have been returned to me, and will all go to the larger American museums. Others, new to the British Museum, are retained in London. This kind of efficiency is possible to the Imperial Institute because the vast collections of the British Museum and a large group of skilled taxonomists are available. This work could not have been done in America, or could only have been done with extreme difficulty. The U. S. National Museum has not yet accepted its responsibility for the development of an adequate collection of the insects of the world.

Economic entomology, since the days when Howard and I were young, has not merely undergone tremendous developments, but has taken on new and diverse aspects. It is disconcerting to me to find that I hardly understand many of the articles now published in the *Journal of Economic Entomology.* They seem to me to be chemical engineering rather than entomology. An army of workers is concerned with the enforcement of regulations, the application of insecticides, and other matters wholly foreign to the simple entomologist of old times. The fact is, that different services require different men, and it is not to be expected that any man to-day can be occupied in all the fields of applied entomology. Dr. Howard recurs from time to time in his book to the necessity for fundamental studies, and it is in this respect that we are most deficient. It ought to be possible to produce, through international cooperation, monographs of all those groups of insects which are of prime importance to man. These should not merely describe the cabinet specimens, but should elucidate life histories, habitats, natural enemies and so forth. The ultimate value of such work, from a purely economic point of view, would be very great indeed. Were I to become young again, and get a new start, I think I should wish to be

a taxonomist as I have been, but on much broader lines, including in my studies generic, specific and varietal differences in physiological characters, in responses of all kinds to the environment. The proverbial man in the street, if he knew me and my program, might hesitate to supply the funds, fearing or knowing that I should not have my eye on his bread and butter. The motive force would not be economic, but scientific, no easier to explain than enthusiasm in playing a game. Only on that basis would the rewards come abundantly to the worker, and the pleasure and zeal be maintained. Seek ye first the Kingdom of Heaven, and all else shall be added unto you, may be adopted as the statement of a psychological principle, fully applicable to-day.

It is at this point that we sense the weakest aspect of modern American entomology. There are in Washington and in the experiment stations and universities many capable workers. But as a general thing they are intellectually dissipated by a multiplicity of duties. They may be well paid and not overworked, but they can not concentrate on comprehensive research. Many, no doubt, have long lost any ability they have had for such labors. There has been no adequate policy for the development of comprehensive scientific research in entomology and little training directed toward that end. We have been sorely deficient in imagination, and have supposed that science could be governed by laws of supply and demand.

The book is well and accurately printed, and I find few errors of any kind. Only one suggests comment. Having visited New Caledonia and followed the footsteps of the famous pioneer naturalist of that island, Pére Montrouzier, I regret to see the now important beetle which was named after him printed (in many places) *Cryptolaemus montrousieri*. I have seen this substitution of s for z elsewhere and hope by this comment to stop the too easy propagation of an error in spelling. A criticism of a quite different kind may be added. We regret that there is, among the pictures of the leading economic entomologists of America, none of the dean of them all, Dr. L. O. Howard.

It seems a long time since the eighties of the last century, when, a lone bachelor in a cabin in Wet Mountain Valley, I first entered into correspondence with the entomologists of the Department of Agriculture, and received from Washington a whole sack full of books and bulletins. The letters used to be signed by Riley, but I understand that most of them were written by Howard. The pleasure and instruction derived from them greatly stimulated my zeal and I think it must be said that in that sense the person responsible for much of what I have accomplished since, whether he approves of it or not, is my old friend Dr. L. O. Howard.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A NEW SPRING BALANCE FOR MEASURING WATER CONTENT OF SNOW[1]

THE water content of snow is determined by weighing a known volume of snow. For example, if a cylindrical prism of snow 1.485 inches in diameter weighs 1 ounce, it contains 1 inch depth of water. To determine the water content of a snow cover a core of snow the full depth of the cover is cut out with a snow tube. This core is weighed, and from its weight the water content is determined.

The problem of weighing the cores in the field under the trying circumstances of cold and storm has presented many difficulties. The fact that measurements of the snow cover must be made on high and almost inaccessible mountains where all travel is on snowshoes or skiis requires a light, portable and convenient instrument for weighing the cores and at the same time one which will give the desired degree of accuracy. Where large numbers of measurements are made, a balance that can be read directly to 0.5 inch of water and can be interpolated to 0.1 inch of water is of sufficient accuracy.

The snow scales developed by the U. S. Weather Bureau, Church of Nevada, as well as commercial scales that have been used in snow surveying, are all spring scales and subject to the inaccuracies inherent in a spring scale. In addition, they are all dial scales, the purpose of the dial being to give a greater readable accuracy and a wider range. These scales have dials which vary from 5 to 10 inches in diameter. They are heavy, awkward to carry, and are subject to binding when the wind swings the tube which is being weighed.

To overcome some of the disadvantages of the scales now in use for measuring the water content of snow, a tubular spring balance has been developed which is believed to be more sensitive and just as accurate and further has the advantage of being lighter and more compact.

[1] Contribution from department of irrigation and drainage engineering, Utah Agricultural Experiment Station.

Publication authorized by Director, August 7, 1930.

This balance is constructed of drawn seamless brass tubing of such diameter that the spiral spring just fits inside the inner tube and the inner tube fits inside the outer tube with clearance to prevent friction. Over the outer tube is placed a slotted tubular slip joint for setting off zero with the empty tube on the scales. The spring is made of 22- or 24-gauge music wire annealed and tempered. The calibration is placed on the inner tube. To calibrate the balance for a particular diameter of core, the equivalent weight of 1 inch of water in a tube of the same diameter as the core is placed on the spring and the unit stretch determined. The gradations are placed on the barrel of the inner tube by rotating the tube against a sharp tool in a lathe which is adjustable to 0.001 inch.

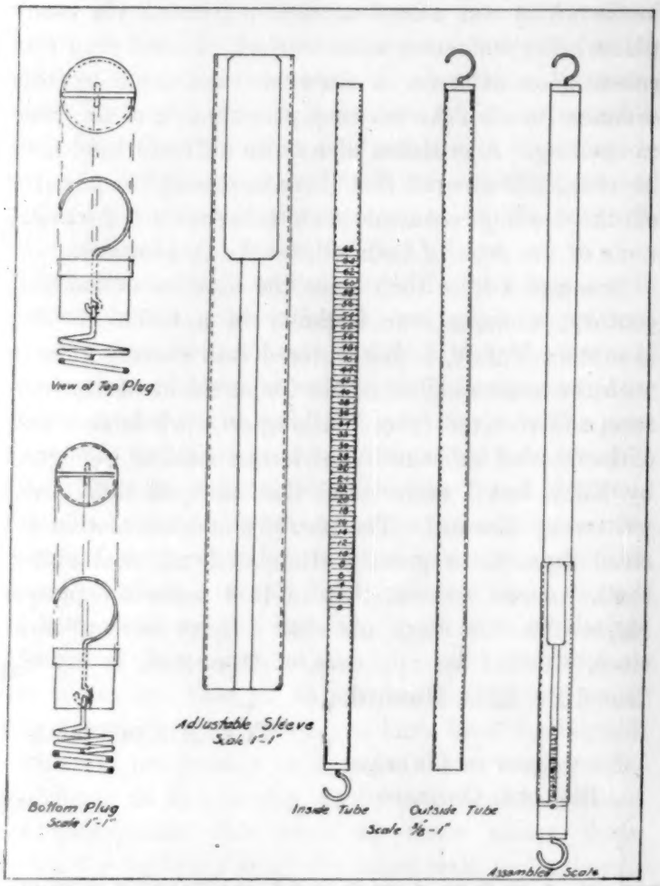

FIG. 1. Parts and assembly of tubular spring balance for measuring water content of snow.

Fig. 1 shows each part of the balance as well as the assembled balance. The hooks are made from 32-gauge piano wire. The plugs are turned out of a bronze rod and the spring is made from 22- or 24-gauge music wire. The drawn seamless brass tubing fits with ample clearance so that there is little friction. The slip sleeve fits the outer tube with spring tightness so that the zero with the empty tube on the scales can be set off. The gauge of wire and diameter of the spiral of the spring will govern the capacity of the balance. A scale having a capacity of 72 inches of water has a distance between each gradation of 0.15 inch. The over-all length of this scale with no load on it is 23 inches; when fully extended it is 41 inches long. This scale weighs 19 ounces. A scale having a capacity of 24 inches has a distance between gradations of 0.21 inch. This scale, weighing only 11 ounces, is 13 inches over all when telescoped and 20 inches long fully extended.

GEORGE D. CLYDE

SPECIAL ARTICLES

COMPARISON BETWEEN IRRADIATION OF DIET AND SUPPLEMENTAL IRRADIATION OF ANIMALS IN VITAMIN A AND D DEFICIENCY[1]

IN an experiment in which eight young rats, about one month old and averaging about 35 g in weight, were placed on a diet that was A-free and low in Vitamin D, on October 14, 1929, and had become well depleted on January 17, 1930, it was found that the addition of 1/100 mgm of irradiated ergosterol daily stimulated their growth for three weeks, but after that time they rapidly succumbed.

In a second experiment (see graph), four lots, consisting of forty-one rats, one month old and averaging 37 gm in weight, were placed on the Sherman No. 380 diet, known to be low in Vitamin D and deficient in Vitamin A, and allowed to become depleted from January 24, 1930. After a period of over eight weeks two of the lots were given irradiated ergosterol, each individual receiving 1/100 mgm daily, mixed with a small quantity of the A-free diet. The other two lots served as positive and negative controls.

RESULTS

The stimulating effects of the Vitamin D thus supplied became quite apparent and lasted for 10 days, then began to subside. The animals in Lot 2 were allowed to exist on the Sherman No. 380 diet, with supplemental Vitamin D, in the form of irradiated ergosterol, but in Lot 1 the animals were also irradiated daily except Sundays, for 30 seconds, at a distance of 18 inches from a Macbeth carbon arc lamp.

Beginning April 28, the additional irradiation was found to markedly stimulate growth for a short time,

[1] Investigations supported by a grant from the National Research Council.

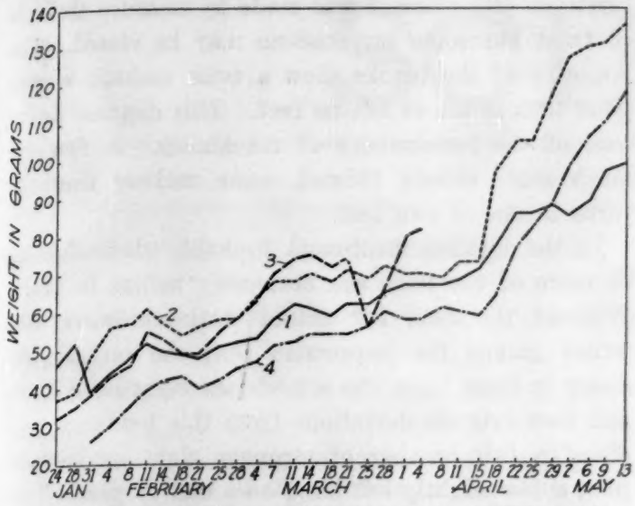

FIG. I IRRADIATED ERGOSTEROL. WITH AND WITHOUT IRRADIATION OF THE ANIMALS

FIG. 1. Lots and Treatment.

1. Sherman No. 380; ergosterol, animals irradiated, April 28.
2. Sherman No. 380; ergosterol.
3. Sherman No. 380; control.
4. Sherman No. 380; cod-liver oil, control.

but did not produce the striking effects on growth and longevity elsewhere described[2] when iodide of iron was added under similar conditions of diet and irradiation.

The chief purpose of our study was of course for comparison with the results obtained with various iodin combinations furnished under the same conditions as in these experiments. It should be noted, however, that the relatively short exposures to ultraviolet light, combined with irradiated ergosterol feeding, did not induce a marked hypervitaminosis.

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HYDROGEN-ION CONCENTRATION OF THE ALIMENTARY TRACTS OF FOWL, CAT AND RABBIT

INVESTIGATORS of biological subjects have long realized the importance of knowing the chemical reactions of biological fluids. Much critical work has shown the quinhydrone electrode and its many modifications suitable for these determinations.

Both in this country and abroad, determinations of the pH of the alimentary tracts of animals[1] have been made. With these observations in mind and having the necessary apparatus available, the writer has attempted to determine the pH of the alimentary tracts of the fowl, the rabbit and the cat.

Animals used in this work were dispatched in the most rapid and painless manner. In the case of fowls the cervical vertebrae were separated by sudden tension. Rabbits were stunned by a smart blow on the head with a blunt instrument, after which they were bled. Cats were rendered insensible by means of overdoses of chloroform. Their respective alimentary tracts were then rapidly and carefully removed to warm physiological salt solution where they were well washed, following which they were again well washed in several changes of distilled water.

Material taken from several points along the tract was then dissolved in distilled water, filtered and the determinations were made upon the filtrate according to the methods outlined by Clark and Collins.[2] The experiments with fowls were nearly all made in the afternoon after the birds had fed at will. Under these conditions, digestion was in active progress. An average of the results obtained from eight fowls shows the following: proventriculus, 5.59; gizzard, 3.39; duodenum, 6.295; ileum, 6.216; cecum, 1.917. These fowls were altogether upon a grain ration; it is possible that somewhat different results might have been secured had there been some meat in their diet.

The alimentary tracts of the rabbits used in these experiments were all healthy and in the absorptive state. Practically all experiments were made from one to two hours after a full feeding of alfalfa and rolled barley. The averages of determinations upon eight rabbits are as follows: stomach, 1.83; duodenum, 7.35; ileum, 7.99; cecum, 6.26.

Some difficulty was experienced in securing cats, which like rats appear not to thrive very well in this locality. Most of the cats were "tramps" of the wandering kind and appeared quite hungry. Some of them harbored ascarid worms and showed slight intestinal irritation. The averages secured from seven cats were as follows: stomach, 3.34; duodenum, 6.51; jejunum, 6.905; ileum, 6.79; colon, 5.25.

Because of the lack of uniformity in the case of cats, the writer does not consider the data secured as consistent and wishes to present it merely as preliminary. It is interesting to note that the intestinal contents of one cat which had been starved for 24 hours showed great uniformity throughout its entire length. In other cases, although the acidity in the

[2] *Proc. Soc. Exp. Biol. and Med.*, 28: 2, 1930.

[1] Hedon and Bremond, "The pH of the Intestine of the Dog," *Bull. Soc. Med. Biol.*, 7: 484, 1926; C. Schwartz and associates, "The pH of the Stomachs of the Cow," *Pflügers Arch. ges. Physiol.*, 213: 587–592, 1926; Danninger, Pfragner and Schultes, "The pH of the Intestinal Tracts of Horses and Cattle," *Pflügers Arch. ges. Physiol.*, 220: 430, 1928; Grayzel and Miller, "The pH of the Gastro-intestinal Tract of the Dog with Relation to Diet and Rickets," *Jour. Biol. Chem.*, 76: 423, 1928.

[2] Clark and Collins, "The Quinhydrone Electrode and Soil Reaction," *Soil Science*, 24: 453, 1927.

stomach is greater than in the intestine, still the reaction always remains acid in the carnivorous cat as compared with the alkaline reaction in the herbivorous rabbit. Undoubtedly very interesting data might be secured from man, whose diet is of a mixed nature.

SUMMARY

Herein has been presented the results secured in determining the pH of the gastrointestinal tract of the hen, the rabbit and the cat by means of the quinhydrone electrode.

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TWIST IN THE GRAIN OF CONIFEROUS TREES

DOUBTLESS many people have noticed that the grain in the trunks of coniferous trees commonly shows a pronounced twist. Perhaps only a few have noticed that this twist is most commonly right-handed. A right-hand screw or helix is one in which clockwise rotation in a nut brings about motion along its axis away from the observer. Such a helix viewed in a horizontal position from the side shows threads sloping from upper left to lower right on the front side as shown in the accompanying sketch.

The writer first observed a preponderant right-hand twist in pine-trees during the field season of 1916 as an assistant with the U. S. Geological Survey in eastern Montana. He recalls making a count of somewhat over two hundred trunks among which were very few showing left-hand twist—not over a half dozen. At that time two or three tentative explanations of the twist were formulated and inquiry made of several botanists as to its cause. No positive explanation was offered. Since 1916 a predominant right-hand twist has been noted in a number of localities, not only in standing and fallen dead trees but also in telephone poles along roads and railroads.

Recently at a locality near the timberline in the Bighorn Mountains west of Buffalo, Wyoming, an exceptional number of bare, fallen trees suggested a careful count of the direction of twist. Four hundred trees, all that showed noticeable twist, were recorded. Three hundred and eighty-four showed right-hand twisting, thirteen had very slight left-hand twists and three showed very strong left-hand twisting. No attempt was made to measure the rate of twist but some impressions may be stated. The majority of the trunks show a twist making a complete turn in ten or fifteen feet. This distance is the *lead* of the terminology of machinists. A few are much more closely twisted, some making complete turns in one or two feet.

Right-hand twist

FIG. 1

In the locality mentioned probably three fourths or more of the trees are noticeably helical in grain. Without the data for actual statistical study the writer gained the impression that the central tendency in these trees was a moderate right-hand twist, and that extreme deviations from this tendency produced a fair number of strongly right-hand examples, a few slightly left-hand ones and very rare pronounced left-hand or closely twisted right-hand examples.

The twisting is not confined to trunks; branches of large size are twisted in some cases and seem to be especially liable to very close twisting. Recent observations at a few other localities indicate that in some places a much smaller number of trees are twisted, and at one place a considerable group of trees appeared to have an excess of left-hand twists. In the main, however, the right-hand twist appears to be far more common. No specific identifications of trees has been made; most of the trees noted in this connection have been pines or spruces. The phenomenon has not been consciously observed in deciduous trees but may possibly occur in some species.

What is the cause of the twist? Why does it show a predominant specific direction and why is that direction right-handed in most groups of trees met with? Several possibilities may be postulated. The twist may be due to a specific set induced in the process of sprouting or some other specific inheritance. Or it might be due to the prevailing counter-clockwise torque resulting from the asymmetrical pressure of prevailing westerly winds on trees with heavier foliage on the south side. Do such trees have asymmetrical foliage and do similar trees in the southern temperate zone show the reverse direction of twist as required by this hypothesis? May topographic control of foliage asymmetries and local anomalies of wind direction explain some of the exceptions noted above?

The above-mentioned facts and suggested interpretations are presented in the hope that others will be able to present more extensive and detailed data and that some reader versed in botany or forestry will offer an accepted or more plausible explanation of the phenomenon.

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